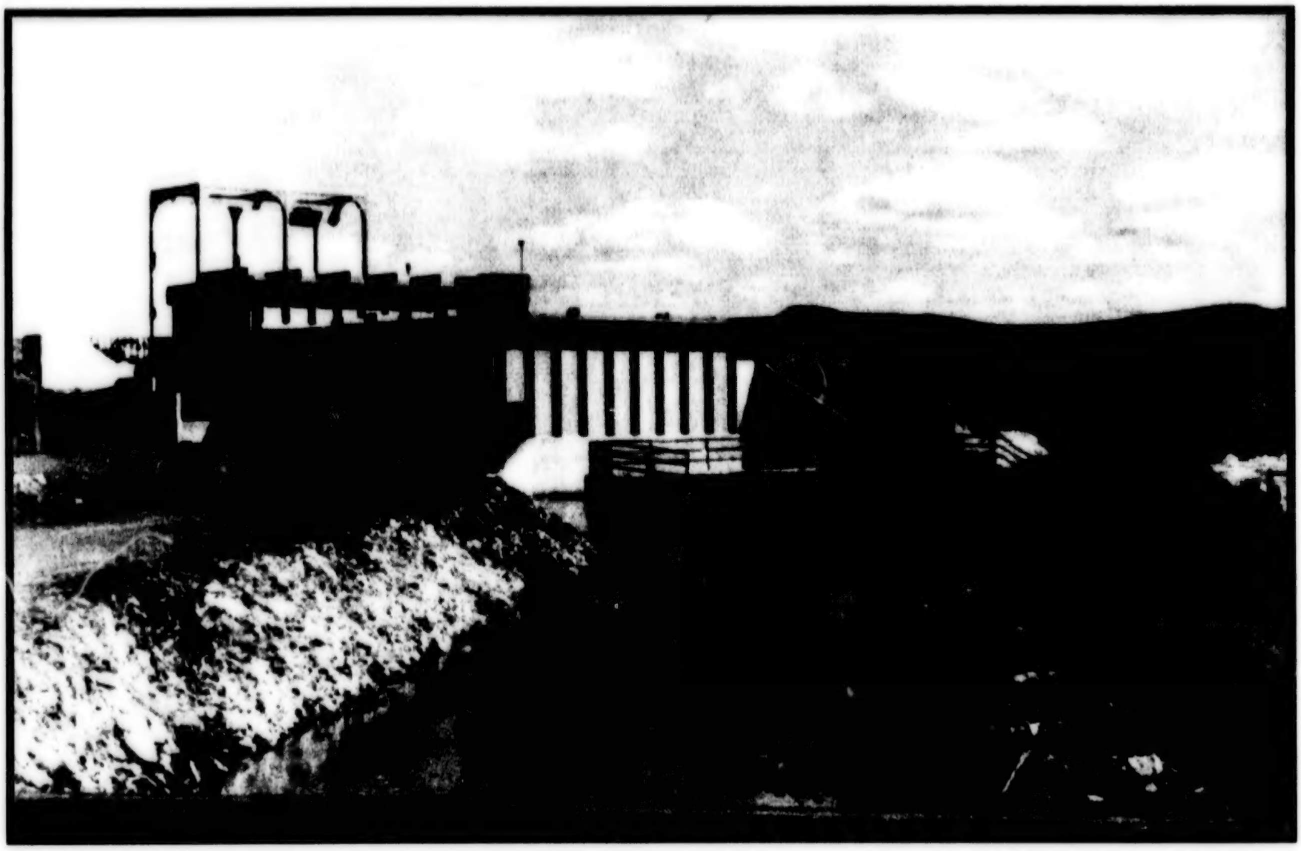
AY 2 0 1997
0612
I 49. 2: C 89

CUI-UI
AND
LAHONTAN CUTTHROAT TROUT
SPAWNING RUNS
AT
MARBLE BLUFF FISH FACILITY
1995



U.S. Department of the Interior
Fish and Wildlife Service

99-008950

C

Cui-ui and Lahontan Cutthroat Trout Spawning Runs At Marble Bluff Fish Facility
1995

Lisa G. Heki
William F. Cowan

U.S. Fish and Wildlife Service
Northern Nevada Fishery Program Office
Reno, Nevada

I

TABLE OF CONTENTS

LIST OF FIGURES iii

LIST OF TABLES iv

INTRODUCTION 1

BACKGROUND 1

Marble Bluff Fish Facility Operations

CUI-UI 2

Cui-ui Spawning Run Summary 2

River Trap Operations 2

Fishway Operations 2

Length Frequencies 5

Sex Ratios 5

Cui-ui Larvae Production 5

LAHONTAN CUTTHROAT TROUT SPAWNING RUN SUMMARY 8

TAHOE SUCKER SPAWNING RUN SUMMARY 11

SUMMARY 11

REFERENCES 13

APPENDIX 1 14

A description of Marble Bluff Fish Facility components and operations, 1978-1994.

APPENDIX 2 17

Daily total numbers of fish released upstream of Marble Bluff Dam, 1995.

II

APPENDIX 3 19

A description of methods to estimate cui-ui numbers filmed on video, 1995.

APPENDIX 4 25

1995 Cui-ui estimates from video footage of river trap releases.

APPENDIX 5 30

Number of cui-ui transported by truck and released upstream of Marble Bluff Dam in 1995.

LIST OF FIGURES

Figure Page

1. Seasonal distribution of cui-ui captured at Marble Bluff Fish Facility in relation to Truckee River discharge 4

2. Comparison of 1995 female and male length frequencies 6

3. A comparison of cui-ui length frequencies, 1993-1995 7

4. Seasonal distribution of Lahontan cutthroat trout captured at Marble Bluff Fish Facility 9

5. Length frequency of female and male Lahontan cutthroat trout captured at Marble Bluff Fish Facility in 1995 10

6. Seasonal distribution of Tahoe suckers captured at Marble Bluff Fish Facility in 1995 12

LIST OF TABLES

Table Page

1. Numbers of cui-ui entering Marble Bluff Fish Facility through the fishway and river trap, 1976-1994 4

2. A summary of cui-ui egg production, larvae produced and percent survival above Marble Bluff Dam for the past three spawning seasons 8

√

INTRODUCTION

This report describes management activities and characteristics of cui-ui (*Chasmistes cujus*), Lahontan cutthroat trout (*Oncorhynchus clarki henshawi*), and Tahoe sucker (*Catostomus tahoensis*) spawner migrations through the Marble Bluff Fish Facility (MBFF) during the spring of 1995.

Marble Bluff Fish Facility Operations

Marble Bluff Fish Facility operations and design have continuously been modified since construction in 1975 to accommodate dynamic environmental conditions and to overcome inherent deficiencies. Appendix 1 describes MBFF components and operations since 1978.

In preparation for the 1995 spawning season, physical modifications and operational changes were made to MBFF to improve passage effectiveness and reduce mortalities. To improve operational efficiency and provide consistent 24 hour operation, MBFF staffing was doubled over the previous year to three crews of 4-5 people working four days a week during two shifts. The crews were staffed by Fish and Wildlife Service personnel from Marble Bluff Fish Facility, Northern Nevada Fishery Program Office, Lahontan National Fish Hatchery, Stillwater National Wildlife Refuge, and volunteers from the National Civilian Community Corps.

To improve passage and regulate the number of cui-ui migrating from Pyramid Lake into the fishway, the Fishery Program Office, in collaboration with Waterman Industries engineers, developed a tilting weir that prevented fish from entering the fishway but allowed fish in the fishway to fall back to the lake. The tilting weir was installed below the terminal ladder at the lake/fishway interface. This reduced overcrowding in the ladders, improved cui-ui migration efficiency, and alleviated the potential for mortality. The area in the canal from the terminal ladder to the lake was further reduced from the 1994 configuration to lessen numbers of cui-ui that could crowd the area at one time.

Several modifications were made to the river trap area to improve passage efficiency from the river. The river trap cage release mechanism was successfully modified to enable immediate release of cui-ui. To reduce or eliminate the need to bring fish into the fish handling building for enumeration, a video camera was installed to film and estimate numbers of cui-ui released through a chute that bypasses the fish handling building. Total run size could then be estimated at a later date. Samples of river trap catches were released into the building to collect data on size and sex ratios. Flood lights were installed to monitor nighttime cui-ui congregations at the base of Marble Bluff Dam.

CUI-UI SPAWNING RUN

Northern Nevada experienced a 150% of normal water year for 1995. Reservoir levels within the Truckee River watershed, which were severely depleted following 6 years of drought, were recharged to capacity. Natural snowpack runoff provided sufficient instream flow in the Truckee River to support a cui-ui spawning migration.

After installation of the tilting weir near the fishway/lake interface on March 29, water was diverted down the fishway channel. The 1995 cui-ui spawning run was characterized by four surges and continued from April 6 through July 14 (Figure 1 and Appendix 2). From June 1 to June 6, approximately 61 percent of the total run was released upstream from the MBFF. On June 4, at least 23,171 cui-ui were conveyed upstream (Appendix 2), setting a record for the most fish moved at the MBFF within a 24-hour period and exceeding total run sizes for 10 of the last 12 runs (Table 1). Because of modifications and sufficient staff, operations were successful in passing the largest migration on record (Table 1) with minimal mortalities. During the spawn season, only 92 cui-ui deaths were attributed to operations of the MBFF. Total run size for 1995 was 112,685 cui-ui.

River Trap Operations

During peak cui-ui spawning migrations, management efforts shifted to convey the maximum number of fish beyond the MBFF without affecting momentum of the run or causing mortalities. Therefore, minimal effort was expended to collect biological data other than total estimated numbers. During these peak migration periods, counts of fish were estimated by viewing video footage of fish released through the fish processing building bypass chute. Appendix 3 explains the method employed to estimate number of cui-ui viewed on video.

An estimated total of 18,492 cui-ui were captured in the river trap and released upstream. Of this total, 15,377 cui-ui were estimated from video footage (Appendix 4). A total of 183 river trap releases were filmed and viewed to estimate number of cui-ui released. Most releases estimated by video footage occurred between June 2 - 8. The total number of cui-ui captured by the river trap and conveyed through the fish handling building was 3,116 fish which comprised approximately 17 percent of the total cui-ui captured by the river trap.

Fishway Operations

A total of 94,193 cui-ui ascended the fishway and were released upstream from MBFF (Appendix 2). This includes 14,510 cui-ui transported by truck on 35 occasions (Appendix 5). The total

Table 1. Numbers of cui-ui entering Marble Bluff Fish Facility through the fishway and the river trap, 1976 - 1994. This table was assembled using information presented by Scoppettone et al. (1986), Coleman (1986), Coleman et al. (1987), Buchanan and Burge (1988), Heki (1994), and raw data collected in 1994 and 1995. Fishway totals include fish netted from ladders and transported upstream from Marble Bluff Dam.

Year	Fishway	River Trap	Sex Ratio (Male:Female)
1976	0	0	
1977	0	0	
1978	33	0	1.0:0.5
1979	139	0	1.0:0.2
1980	4,984	0	1.0:0.5
1981	47	0	1.0:0.8
1982	13,804	1	1.0:1.3
1983	5,994	20	1.0:1.3
1984	0	11,374	1.0:2.5
1985	0	9,502	1.0:1.9
1986	0	35,080	1.0:1.3
1987	0	5,301	1.0:1.9
1993	15,558	3,095	1.0:0.4
1994	47,434	18,911	1.0:0.5
1995	94,193	18,492	1.0:0.7

BLANK
PAGE

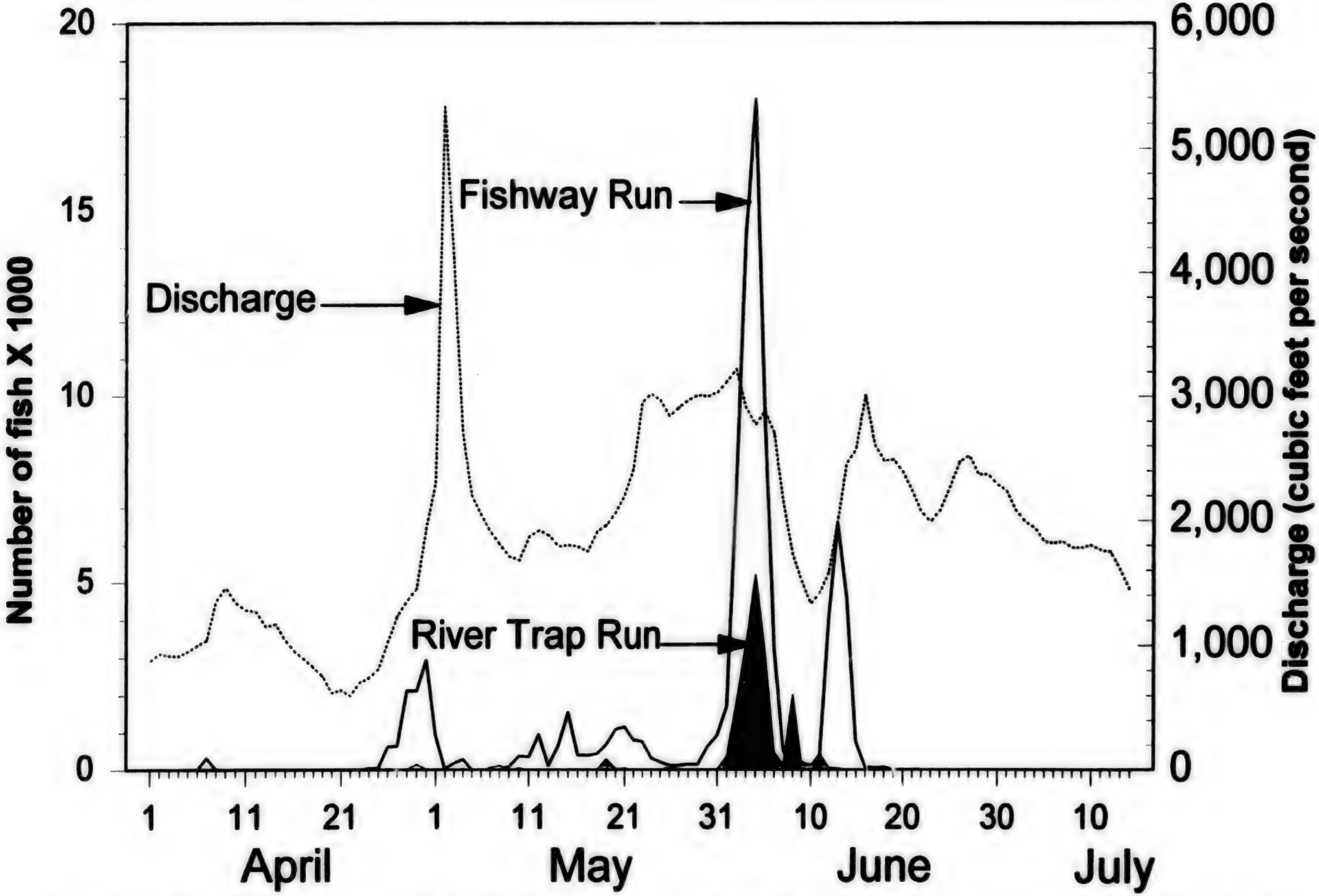


Figure 1. Seasonal distribution of cui-ui captured at Marble Bluff Fish Facility in relation to Truckee River discharge (USGS 1996) measured at Nixon, Nevada, 1995. Total cui-ui captured from the fishway and river trap were 94,193 and 18,492, respectively.

(Appendix 2). This includes 14,510 cui-ui transported by truck on 35 occasions (Appendix 5). The total sample of cui-ui that were sexed or measured was 17,921 fish and comprised approximately 19 percent of the total cui-ui captured from the fishway. The tilting weir was used successfully to reduce overcrowding in all four ladders. This improved swimming efficiency and significantly reduced incidence of mortality. The weir was easily raised and lowered by one person.

Cui-ui Length Frequencies

A sampling scheme of measuring fork lengths from the first 100 cui-ui captured during a work shift resulted in an over-represented sample from the fishway (n=7523) versus the river trap (n=1045). An analysis of variance for fish measured indicate that females were significantly larger than males (P<0.001), whereas, lengths among capture locations were not significant (P=0.092). Cui-ui length frequencies, irrespective of capture location, are presented in figure 2. The mean fork length for females was 541 mm +/- 31.3 (SD), whereas, the mean fork length for males was 508 mm +/- 28.6 (SD). Mean fork lengths for both sexes were not significantly different between 1994 and 1995 (P=0.265), but were significantly smaller in 1993 (P<0.001) (Figure 3). Length frequency, cohort composition, and aging studies of the cui-ui population in Pyramid Lake are currently being conducted by the United States Geological Survey - Biological Resources Division (USGS-BRD), and may reveal some reasons why mean size of cui-ui did not increase in 1995.

Sex Ratios

Without adjustment for disproportional sampling, the overall sex ratio for the 1995 spawning run was 1.0 male to 0.7 female. This ratio reflects a greater proportion of females than observed in 1993 and 1994 and is consistent with the noted shift for a preponderance of males in the spawning run beginning in 1993 (Table 1).

Cui-ui Larvae Production

Based on USGS-BRD provisional data, egg and larvae production doubled over the 1994 spawning season and corresponds to the twofold increase of cui-ui assisted upstream. Larvae survival produced upstream of Marble Bluff Dam was also higher than the 1994 season.

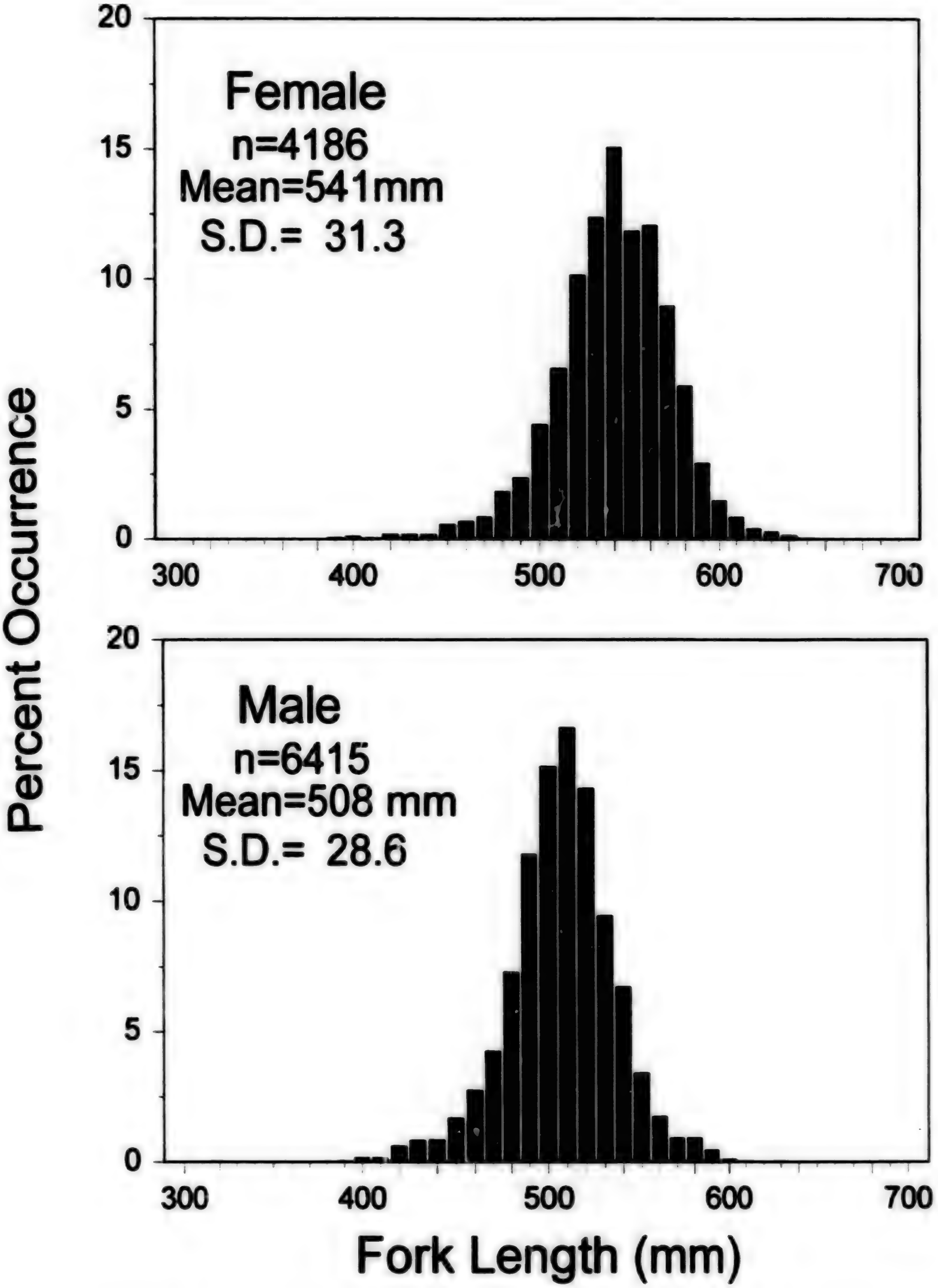


Figure 2. Comparison of 1995 female and male length frequencies. Data are not adjusted for disproportional sampling.

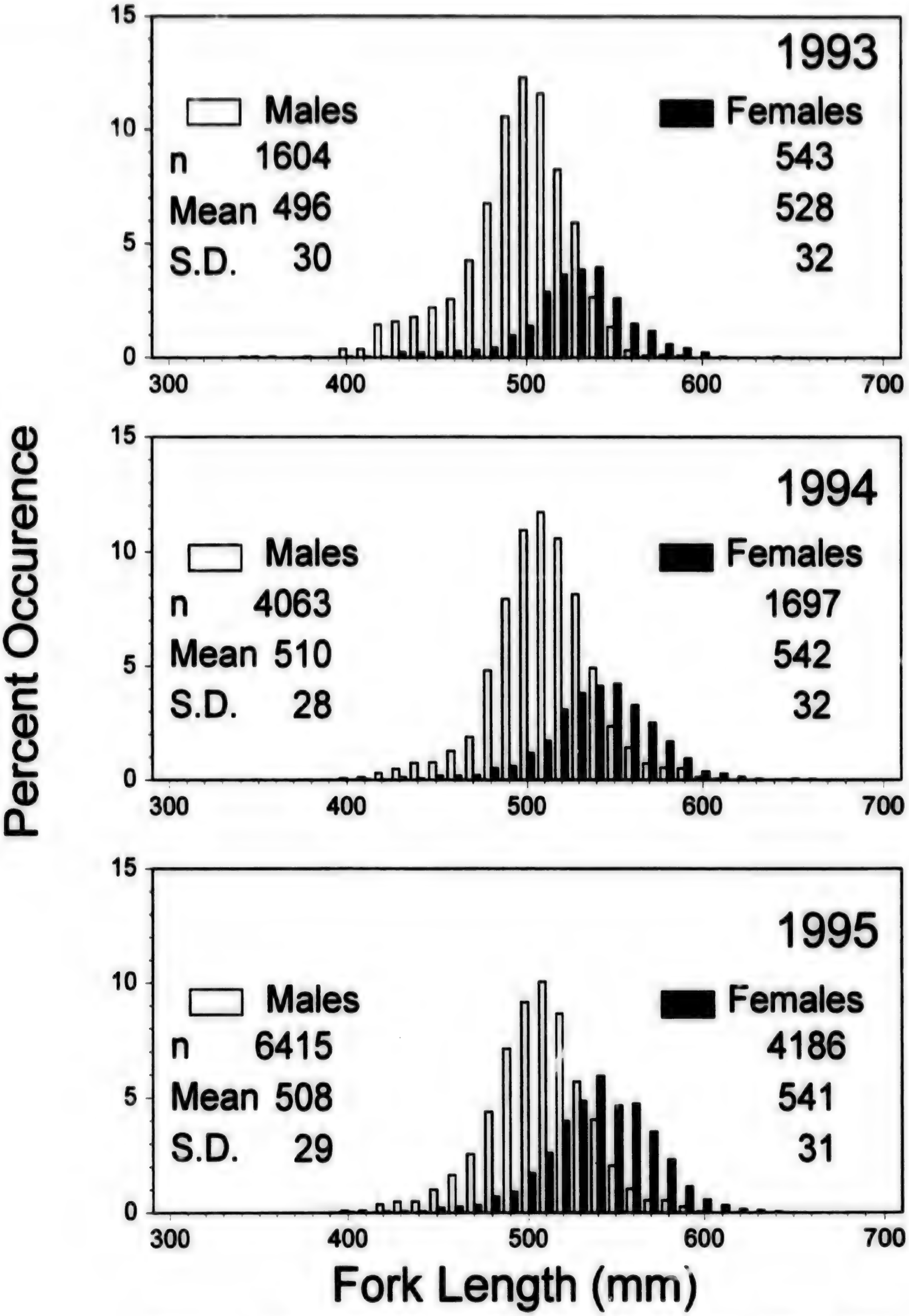


Figure 3. A comparison of cui-ui length frequencies, 1993 - 1995. Data are not adjusted for disproportional sampling.

Table 2. A summary of cui-ui egg production, larvae produced and percent survival above Marble Bluff Dam for the past three spawning seasons (USGS-BRD provisional data).

Year	Eggs Produced (Millions)	Larvae (Millions)	Larvae Survival (Percent)
1993	322	27	8.4
1994	1,632	79	4.8
1995	3,379	303	9.0

LAHONTAN CUTTHROAT TROUT SPAWNING RUN

The Lahontan cutthroat trout (LCT) spawning run enumerated at MBFF in 1995 started April 3 and continued until June 28. Daily counts fluctuated throughout the season (Appendix 2) and appear to be related to water temperatures. Three day totals are presented in Figure 4 to better illustrate temporal trends. Most fish were captured from mid-April through mid-May. Peak movement occurred when mean daily water temperatures ranged from 7° to 12° C.

Annual LCT spawning run size at MBFF ranged from 42 fish in 1980 (Coleman 1986) to 1,347 fish in 1986 (Coleman et al. 1987). In 1995, at least 170 LCT were enumerated at MBFF which includes 117 captured in the river trap and 53 captured from the fishway (Appendix 2). The number of LCT present in river trap releases made through the fish processing building bypass chute is unknown. Most of the LCT captured except for 18 fish, were sexed and measured. The 1995 LCT spawner sex ratio was 1.0 male to 1.5 females and is consistent with previous years.

Mature LCT ranged in fork length from 295 mm to 860 mm. Males were generally larger than females with a mean fork length of 485 mm compared to 421 mm (Figure 5). Mean size of spawners in 1995 have decreased when compared to spawn runs prior to 1987. From 1979 to 1987 mean fork length of females ranged from 458 mm to 548 mm, while males ranged from 485 to 598 mm (Coleman 1986, Coleman et al. 1987, Buchanan and Burge 1988). Tagging studies performed by Pyramid Lake Fisheries have noted a trend for smaller LCT beginning with the 1986 year class (Monda 1994). Previous investigations of length/age relationships for Pyramid Lake LCT (Coleman et al. 1987, Monda 1994) indicate that 1995 spawners likely ranged from 2 to 8 years old.

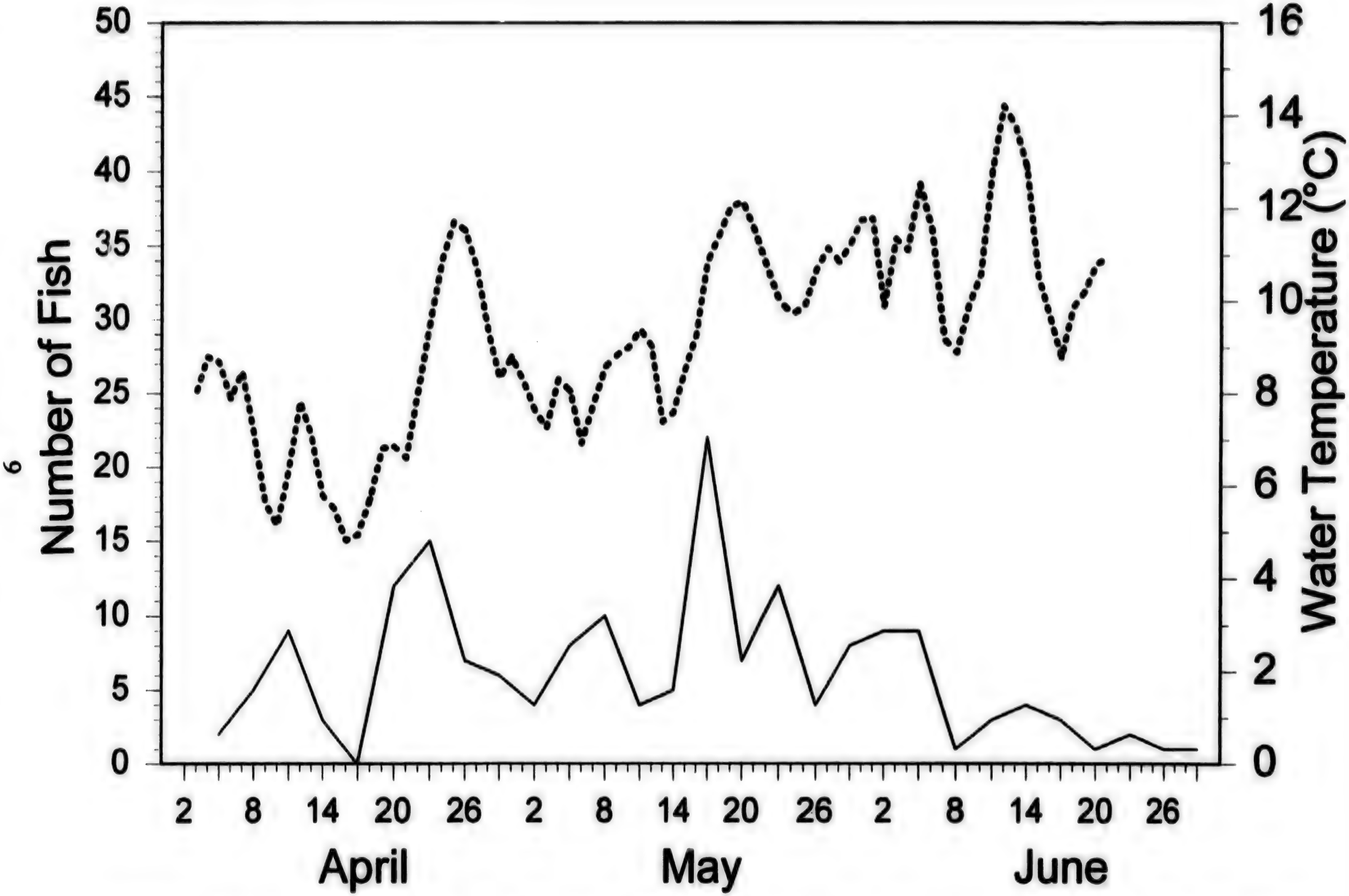


Figure 4. Seasonal distribution (three day totals) of Lahontan cutthroat trout captured at Marble Bluff Fish Facility in relation to mean daily water temperatures (dashed line) in 1995.

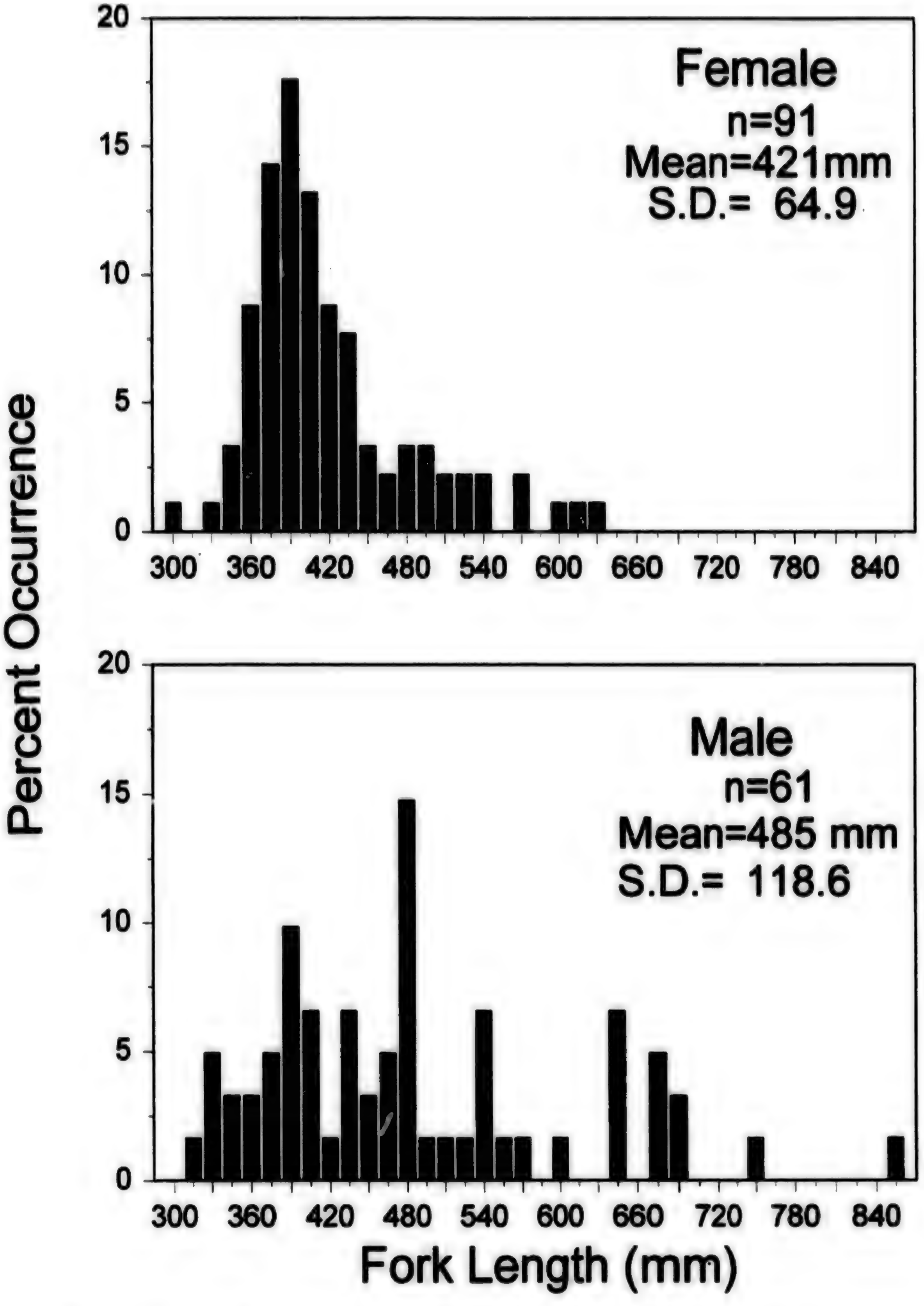


Figure 5. Length frequency of female and male Lahontan cutthroat trout captured at Marble Bluff Fish Facility in 1995.

At the request of Pyramid Lake Fisheries, a total of five large males captured at MBFF were transferred to their hatchery facilities. These fish ranged in fork length from 650-860 mm.

TAHOE SUCKER SPAWNING RUN

The Tahoe sucker spawn run in 1995 extended throughout the entire operational period at MBFF. A major peak in the run occurred April 25-29 (Figure 6). At least 19,068 Tahoe suckers passed through MBFF in 1995 (Appendix 2). No sex or length data were collected on these fish.

SUMMARY

Excluding the drought years, yearly modifications have been made to MBFF in an attempt to improve attraction, reduce mortalities, and increase spawning run size of cui-ui. Lahontan cutthroat trout and Tahoe suckers appear to be unaffected by modifications to MBFF. Relative abundance and size of LCT spawners have exhibited a downward trend from runs experienced in 1986 and before; however, this trend may be related to stocking activities and the lack of recruitment from the Truckee River. Cui-ui mortalities have occurred to varying degrees since MBFF was constructed despite the minor annual modifications that have occurred. The inherent limitations of MBFF for cui-ui have not been overcome. The size of the cui-ui population, in conjunction with their migration behavior, will require a major redesign of MBFF, or lake elevations high enough to provide for uninhibited passage over Marble Bluff Dam, if cui-ui recovery is to be achieved. Currently only a small percentage of the adult population is passed through MBFF to spawning habitat in the lower Truckee River. Furthermore, the longer the population holds in Pyramid Lake waiting for their opportunity to spawn, the greater the impact of pelican predation.

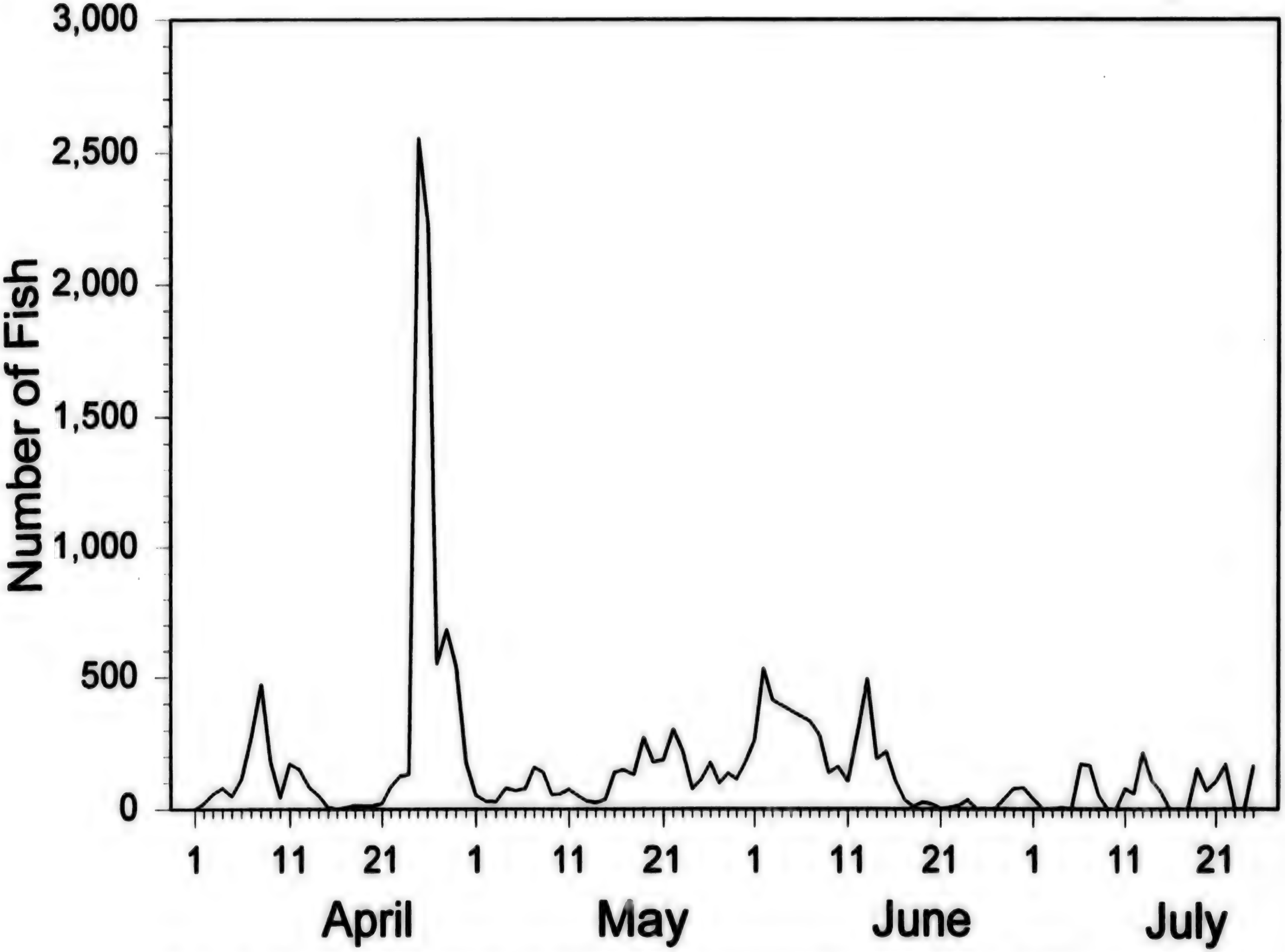


Figure 6. Seasonal distribution of Tahoe suckers captured at Marble Bluff Fish Facility in 1995.

References

Buchanan, C.C., and H.L. Burge. 1988. Cui-ui and Lahontan cutthroat trout spawning runs at Marble Bluff Fish Facility - 1987. Unpublished report, U.S. Fish and Wildlife Service, Great Basin Complex, Reno, NV, 29 pp.

Coleman, M.E. 1986. Evaluation of spawning runs at the Marble Bluff Fish Facility, Nixon, Nevada, 1978 to 1985. U.S. Fish and Wildlife Service. Fisheries Resources report FR1/FAO-86-11, Portland, OR, 93 pp.

Coleman, M.E., C.C. Buchanan, and H.L. Burge. 1987. Spawning runs from Pyramid Lake in 1986 and studies of cui-ui life history. Unpublished report, U.S. Fish and Wildlife Service, Great Basin Complex, Reno, NV, 64 pp.

Heki, L.G. 1994. Cui-ui and Lahontan cutthroat trout spawning runs at Marble Bluff Fish Facility 1988-1993. Unpublished report, U.S. Fish and Wildlife Service, Division of Fisheries - Region 1, Portland, OR, 19 pp.

Monda, D. 1994. Summary of microtag data from 1975 through February, 1992. Unpublished report, Pyramid Lake Fisheries, Sutcliff, NV, 17 pp.

Scoppettone, G.G., M. Coleman, and G.A. Wedemeyer. 1986. Life history and status of the endangered cui-ui of Pyramid Lake, Nevada. U.S. Fish and Wildlife Service, Fish and Wildlife Research 1, 23 pp.

USGS (United States Geological Survey). 1996. Water resources data Nevada water year 1995. U.S. Geological Survey Water-Data Report NV-95-1.

Appendix 1. A Description of Marble Bluff Fish Facility Components and Operations, 1978-1994.

Marble Bluff Fish Facility Description

Marble Bluff Fish Facility consists of four major components: Marble Bluff Dam, fish handling building, river trap, and fishway. Marble Bluff Dam was constructed by the Bureau of Reclamation to provide grade control for the lower Truckee River and to impound and divert water to the fishway. The dam is approximately 175 feet across and 40 feet high with a baffled concrete apron. The fishway extends 3.1 miles from the fish handling building at the northwest side of the dam to Pyramid Lake. It consists of a clay-lined, earthen canal, 3 feet deep by 8 feet wide and four concrete ladders, 8 feet deep. The fishway operates at flows between 30 and 50 cubic feet per second (cfs) and is functional when the level of Pyramid Lake is between 3,784 and 3,810 feet above mean sea level.

Originally, MBFF ladder design was patterned after fish ladders used at Ice Harbor Dam on the Snake River, Washington, with 27 concrete baffles, each baffle containing a 1-foot by 1-foot bottom orifice, with the ladder ascending a 1:10 slope. In 1983, the orifices were blocked with plywood to reduce turbulence and wooden weirs were inserted between each concrete weir to reduce the height barrier. In this modified ladder design, water flows over the weirs in a zigzag pattern, with water depth over each weir not exceeding 7-inches. Velocity within each ladder can be regulated with a valve at the head of each ladder. Water is diverted laterally to a valve box where it is rediverted at four sites along the lower third of the ladder. Water depth in all four ladders is 8-feet when fishway flows are 40 cfs. Cui-ui use the low velocity space downstream of each weir as resting places.

After ascending the fishway, all fish pass through the fish handling building. The building contains a V-weir, fish-holding pens, a fish-sorting table, and associated equipment used to crowd and transport fish upstream of the dam. All fish entering the building from the fishway are counted; randomly selected fish are measured, sexed, and checked for tags; then fish are released upstream of Marble Bluff Dam.

The river trap is located between the fish handling building and the base of the dam and consists of a concrete channel, V-weir, and fish elevator. The river trap is only accessible when the Truckee River delta allows fish passage. Once at the base of the dam, cui-ui locate the 10-feet wide river trap channel. They migrate approximately 40 feet up the channel and make a 90 degree turn into the entrance of the river trap cage. The cage is raised 40 feet to either the elevation of the fish handling building where the fish are processed as described earlier or raised to the river elevation upstream of the dam. Two factors, lake elevation and river discharge, determine river access. It has been estimated that minimum lake elevation necessary for delta passage is between 3810 and 3815 feet above mean sea level (Buchanan, 1987 and 1988). However, during the 1993, 1994, and 1995 spawning seasons, sporadic delta passage was achieved by cui-ui at lake elevations of 3797 feet and lower. The dynamics that created the ephemeral channels through the delta are complex and it is currently unclear how reliable this passage may be. There are several advantages to delta passage: Runs tend to be earlier and larger; it is less stressful to migrating cui-ui than the fishway; and it provides relatively non-selective passage for males and females of all age classes (Buchanan and Strekal 1988).

Marble Bluff Fish Facility Operations from 1978 - 1994

Marble Bluff Fish Facility was constructed to provide access for cui-ui and Lahontan cutthroat trout (LCT) from Pyramid Lake into historical spawning habitat in the lower Truckee River. An impediment to natural spawning migrations was created following the construction of Derby Dam in 1905 which diverted a large portion of the Truckee River to the Carson River Basin. Consequently, Pyramid Lake elevations declined rapidly, causing erosion and the formation of an expansive delta at the mouth of the Truckee River. Cui-ui, because they are a long-lived species, were able to persist despite subsequent years with little or no recruitment. At the time MBFF was constructed there were only two major year classes: 1950 and 1969. The original strain of LCT was extirpated by the early 1940's. The current strain of LCT in Pyramid Lake is a conglomerate of several lake strains and is sustained by hatchery production. No natural reproduction by LCT has been documented to date.

Cui-ui spawning migrations did not occur immediately following the construction of MBFF (Coleman, 1986). The ladder design in the fishway, which was patterned after salmon ladders from the northwest, created velocity and gradient barriers to cui-ui. The first run of 33 individuals occurred in 1978 (Table 1). Fish ladder design limitations were progressively improved from 1978 to 1982 by inserting wooden baffles between the concrete baffles and blocking the orifices, thereby reducing velocity and head height in each ladder. The last ladder was modified prior to the 1982 spawning run. The largest fishway migration during the early years of fishway operation was 13,804 cui-ui in 1982 (Table 1). A small run occurred in 1983; the last year the fishway was used by cui-ui prior to the 1993 spawning run.

Above normal water years from 1983 through 1986 increased Pyramid Lake elevation from 3,793 feet to 3,816 feet, its highest point since construction of MBFF, and resulted in reliable delta access for cui-ui. Spawning runs between 1984 and 1987 were assisted upstream at the river trap rather than the fishway (Table 1). During that period, some effort was made to improve river trap design and to develop a bypass ladder around the building. The bypass ladder never functioned properly and was abandoned. The original river trap was replaced after the 1987 season by a cage system that retained water as it was lifted.

Following the 1987 spawning season, the region experienced a severe drought which prevented cui-ui spawning migrations for the next five years. Limited or no snowpack runoff during these years severely reduced instream flow in the Truckee River, resulting in poor spawning and rearing conditions. Storage in Stampede Reservoir had been depleted during the 1987 spawning season and therefore water was not available to support any spawning runs during this period. No modifications to MBFF were planned or implemented during this period of dormancy to address the larger cui-ui populations.

The 1993 winter was greater than normal and provided the opportunity to induce a cui-ui spawning migration and sustain the run with releases from Stampede Reservoir. Cui-ui attempted to migrate by April 1 during unseasonably warm temperatures, earlier than previous spawning runs through MBFF. It quickly became apparent that there were more cui-ui in the adult population than had been reported to date. Marble Bluff Fish Facility and staff were rapidly overwhelmed by the number of cui-ui migrating both the fishway and the river trap. The new river trap cage, which had never been tested, had a flawed gate design that did not properly function when large quantities of fish (i.e. > 2000) were present, resulting in mortalities. The ladder system was still a significant limitation where tens of thousand of cui-ui that attempted entrance to the terminal ladder were unable to migrate and thousands were killed. However, personnel managed to assist 18,653 cui-ui upstream, the second largest run at MBFF at that time but less than 3.5% of the pre-spawning aggregate.

Although 1994 was another drought year, sufficient water was stored in Stampede Reservoir to support the instream flows necessary for a cui-ui spawning run. The Service made minor modifications to MBFF based on the experiences during the 1993 spawning season.
Cui-ui access to the fishway was restricted and the Service added four people to operate MBFF. The majority of cui-ui were assisted through the fishway and passed upstream. Total run size was 66,345 cui-ui, a new record for MBFF with a greater participation of the pre-spawning aggregate than the previous year, approximately 6.3% of the pre-spawning aggregate.

Appendix 2. Daily Total Numbers of Fish Released Upstream From the Marble Bluff Dam in 1995.

Fishway cui-ui totals include fish transported during emergency trucking operations.

	Fishway			River Trap			Combined River Trap and Fishway		
Date	Tahoes	LCT	Cui-ui	Tahoes	LCT	Cui-ui	Tahoes	LCT	Cui-ui
NR						51			51
04/02/95	3	0	0	19	0	0	22	0	0
04/03/95	4	0	0	53	2	0	57	2	0
04/04/95	8	0	0	71	0	0	79	0	0
04/05/95	15	0	0	33	0	0	48	0	0
04/06/95	51	0	3	64	1	0	115	1	3
04/07/95	207	0	314	66	0	0	273	0	314
04/08/95	418	1	9	53	3	0	471	4	9
04/09/95	121	3	0	60	0	0	181	3	0
04/10/95	30	1	1	14	1	0	44	2	1
04/11/95	144	1	0	28	3	0	172	4	0
04/12/95	127	0	1	23	1	0	150	1	1
04/13/95	68	0	1	15	2	0	83	2	1
04/14/95	26	0	0	26	0	0	52	0	0
04/15/95	7	0	1	Trap not operated			7	0	1
04/16/95	0	0	0	Trap not operated			0	0	0
04/17/95	1	0	0	6	0	0	7	0	0
04/18/95	1	0	1	13	1	0	14	1	1
04/19/95	2	0	5	9	4	0	11	4	5
04/20/95	6	1	1	7	6	0	13	7	1
04/21/95	5	1	0	18	6	0	23	7	0
04/22/95	2	0	0	83	0	0	85	0	0
04/23/95	8	1	2	117	0	0	125	1	2
04/24/95	8	0	35	124	0	0	132	0	35
04/25/95	1929	0	35	626	5	3	2555	5	38
04/26/95	2049	0	611	170	2	39	2219	2	650
04/27/95	312	0	638	239	3	9	551	3	647
04/28/95	137	0	2125	544	3	5	681	3	2130
04/29/95	170	0	2116	371	0	146	541	0	2262
04/30/95	48	1	2942	129	1	17	177	2	2959
05/01/95	42	0	915	12	1	2	54	1	917
05/02/95	26	1	24	4	0	0	30	1	24
05/03/95	28	0	177	0	0	0	28	0	177
05/04/95	34	0	281	45	1	40	79	1	321
05/05/95	10	7	6	59	0	1	69	7	7
05/06/95	20	0	0	57	2	0	77	2	0
05/07/95	15	0	1	143	5	54	158	5	55
05/08/95	22	2	20	118	1	119	140	3	139
05/09/95	6	0	77	49	0	14	55	0	91
05/10/95	9	0	366	49	2	49	58	2	415
05/11/95	16	1	340	59	1	4	75	2	344
05/12/95	13	2	943	38	1	0	51	3	943
05/13/95	2	0	103	29	1	0	31	1	103
05/14/95	3	0	652	21	1	1	24	1	653
05/15/95	20	0	1542	16	7	0	36	7	1542
05/16/95	81	0	399	58	5	0	139	5	399
05/17/95	126	1	381	22	9	1	148	10	382
05/18/95	101	0	427	28	1	3	129	1	430
05/19/95	126	3	670	143	0	296	269	3	966
05/20/95	97	0	1080	81	3	32	178	3	1112
05/21/95	48	1	1158	138	0	42	186	1	1200
05/22/95	123	3	796	178	8	6	301	11	802
05/23/95	152	0	750	66	0	5	218	0	755
05/24/95	29	2	306	48	0	14	77	2	320
05/25/95	51	0	205	62	0	9	113	0	214
05/26/95	51	1	114	125	1	63	176	2	177
05/27/95	17	2	107	81	2	32	98	4	139
05/28/95	77	0	154	59	2	1	136	2	155
05/29/95	38	0	144	75	2	7	113	2	151
05/30/95	62	0	614	118	0	4	180	0	618
05/31/95	105	0	921	153	2	12	258	2	933
06/01/95	178	7	1702	353	0	374	531	7	2076
06/02/95	369	5	7563	43	4	1807	412	9	9370
06/03/95	574	0	14362	NR	0	3355	574	0	17717
06/04/95	475	0	17958	NR	0	5213	475	0	23171
06/05/95	257	0	9409	NR	0	3166	257	0	12575
06/06/95	309	0	3205	24	0	476	333	0	3681
06/07/95	160	1	489	122	0	146	282	0	635
06/08/95	45	0	115	93	1	2025	138	0	2140
06/09/95	106	0	199	55	1	133	161	1	332
06/10/95	54	0	110	51	1	110	105	1	220
06/11/95	130	0	337	156	3	439	286	3	776
06/12/95	392	1	4082	99	0	61	491	1	4143
06/13/95	141	0	6590	49	0	47	190	0	6637

Appendix 2. Daily Total Numbers of Fish Released Upstream From the Marble Bluff Dam in 1995.

Fishway cui-ui totals include fish transported during emergency trucking operations.

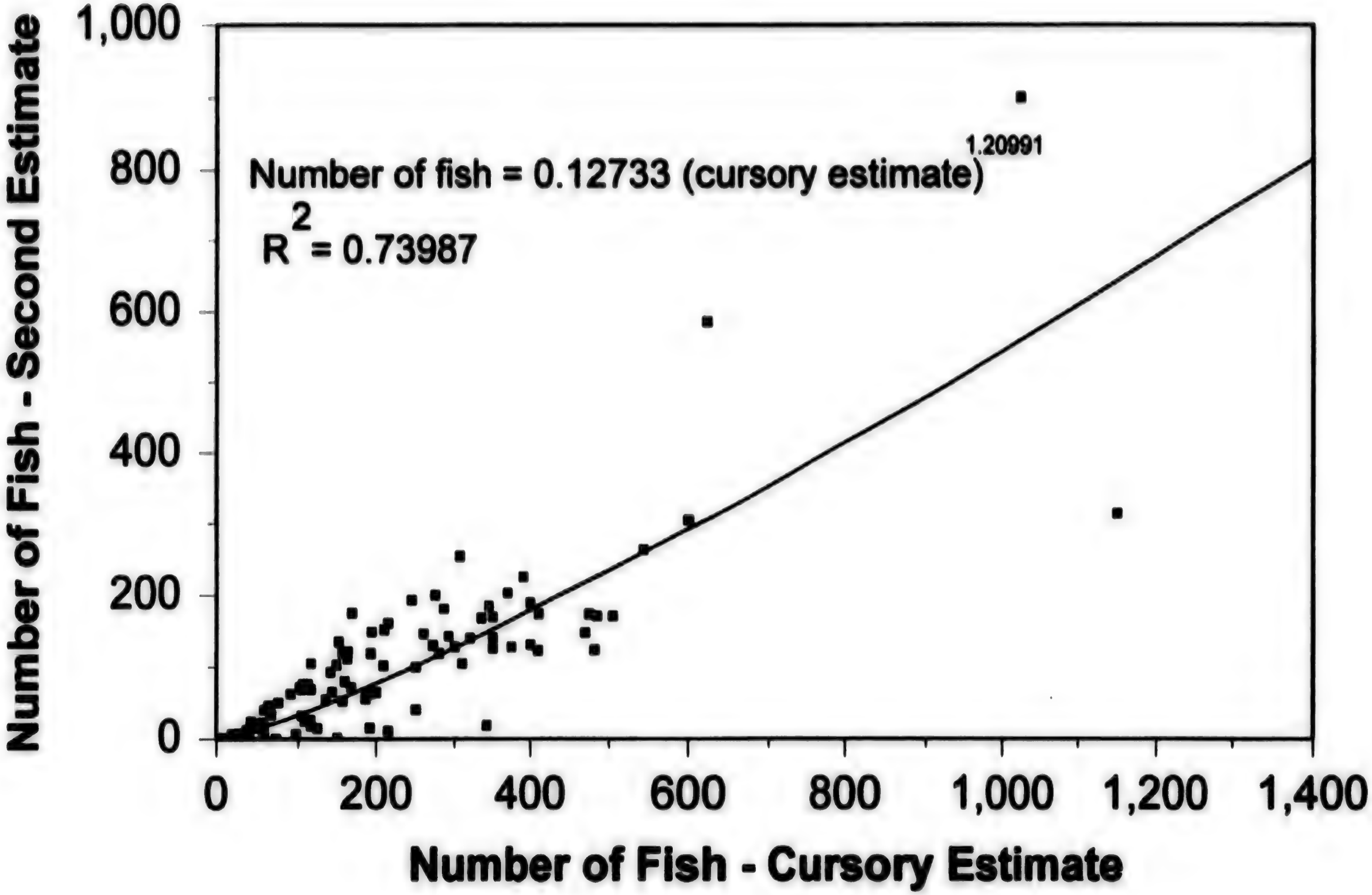
	Fishway			River Trap			Combined River Trap and Fishway		
Date	Tahoes	LCT	Cui-ui	Tahoes	LCT	Cui-ui	Tahoes	LCT	Cui-ui
06/14/95	63	0	4581	154	1	9	217	1	4590
06/15/95	41	1	761	65	0	0	106	1	761
06/16/95	7	0	76	27	1	1	34	1	77
06/17/95	8	0	53	NR	0	7	8	0	60
06/18/95	13	0	70	13	1	7	26	1	77
06/19/95	13	0	1	6	0	3	19	0	4
06/20/95	1	1	2	1	0	0	2	1	2
06/21/95	2	0	2	3	1	1	5	1	3
06/22/95	NR	0	0	12	0	10	12	0	10
06/23/95	6	0	1	29	1	16	35	1	17
06/24/95	NR	NR	0	NR	NR	NR	0	0	0
06/25/95	NR	NR	0	NR	NR	NR	0	0	0
06/26/95	NR	NR	0	NR	NR	NR	0	0	0
06/27/95	NR	NR	5	40	0	0	40	0	5
06/28/95	2	1	0	75	0	0	77	1	0
06/29/95	35	0	1	44	0	0	79	0	1
06/30/95	1	0	0	37	0	0	38	0	0
07/01/95	NR	NR	0	NR	NR	NR	0	0	0
07/02/95	NR	NR	0	NR	NR	NR	0	0	0
07/03/95	0	0	0	6	0	0	6	0	0
07/04/95	NR	NR	0	NR	NR	NR	0	0	0
07/05/95	135	0	1	34	0	2	169	0	3
07/06/95	118	0	1	47	0	1	165	0	2
07/07/95	41	0	3	10	0	0	51	0	3
07/08/95	NR	NR	NR	NR	NR	NR	0	0	0
07/09/95	NR	NR	NR	NR	NR	NR	0	0	0
07/10/95	53	0	0	23	0	0	76	0	0
07/11/95	8	0	0	49	0	0	57	0	0
07/12/95	132	0	0	80	0	0	212	0	0
07/13/95	92	0	0	16	0	1	108	0	1
07/14/95	60	0	0	6	0	1	66	0	1
07/15/95	NR	NR	NR	NR	NR	NR	0	0	0
07/16/95	NR	NR	NR	NR	NR	NR	0	0	0
07/17/95	NR	NR	NR	NR	NR	NR	0	0	0
07/18/95	18	0	0	133	0	0	151	0	0
07/19/95	8	0	0	62	0	0	68	0	0
07/20/95	94	0	0	10	0	0	104	0	0
07/21/95	113	0	0	54	0	0	167	0	0
07/22/95	NR	NR	NR	NR	NR	NR	0	0	0
07/23/95	NR	NR	NR	NR	NR	NR	0	0	0
07/24/95	117	0	0	46	0	0	163	0	0
	11826	53	94193	7242	117	18492	19068	170	112685

Appendix 3. A Description of Methods to Estimate Cui-ui Numbers Filmed on Video in 1995.

During the run cursory counts of cui-ui (designated as first counts) were made on a 12-inch monitor to provide a daily tally of fish. Subsequent viewing on a 27-inch monitor allowed more accurate counts based on size differences between cui-ui and Tahoe suckers. Most releases were viewed three times (designated as second - fourth counts) on a 27-inch monitor and compared with cursory counts. Cursory counts viewed on a 12-inch monitor were consistently greater than secondary counts viewed on a 27-inch monitor. Because standard deviations and means incorporating all counts were inherently biased, cursory estimates were disregarded except when river trap releases were partially recorded or erased.

A regression between 102 cursory and secondary estimates of cui-ui counts captured in the river trap (Figure 1 of this appendix) was used to back-calculate 16 river trap releases that were partially recorded or erased. A proportional density estimate (designated as "Estimate of Missing Data" in Appendix 4) was added to secondary counts for 20 river trap releases where estimates of time could be applied to a missing segment of the release. Estimates for the remaining river trap releases used mean values of secondary counts (i.e. second - fourth counts) as the final estimate. The following spreadsheet, figure, and Appendix 4 present results of video counts.

BLANK
PAGE



Appendix 3 (Figure 1). A power regression between cursory and secondary estimates of cui-ui spawners captured in the river trap and viewed from video footage, 1995.

Appendix 3. A Description of Methods to Estimate Cui-ui Numbers Filmed on Video in 1995.

Date	Time	First Count	Second Count	Third Count	Fourth Count	Mean Count (1st - 4th)	Standard Deviation (1st-4th Counts)	Mean Count (2nd - 4th)	Standard Deviation (2nd-4th Counts)	Comments
NR	NR		0	0	0	0	0	0	0.0	
NR	NR		0	0	0	0	0.0	0	0.0	
NR	NR		10	12	10	11	1.2	11	1.2	
NR	NR		36	43	40	40	3.5	40	3.5	
NR	NR		1	1	1	1	0.0	1	0.0	Camera repositioned
NR	NR		0	0	0	0	0.0	0	0.0	2-Tahoes
NR	NR		0	0	0	4	0.0	0	0.0	4-Tahoes
NR	NR		0	0	0	16	0.0	0	0.0	
NR	NR		0	0	0	21	0.0	0	0.0	
NR	NR		0	0	0	55	0.0	0	0.0	
04/29/95	22:40:00	52								Could not determine sets on tape
05/10/95	23:02:00	4	0	0	0		2.0		0.0	MBFF 95' Tape #1, 5-Tahoes
06/01/95	18:13:00	190								Could not determine sets on tape
06/01/95	18:30:00	300								Could not determine sets on tape
06/01/95	23:48:00	49	18	18	18	26	15.5	18	0.0	
06/02/95	10:42:00	245	182	197	201	206	27.1	193	10.0	Sunlight glare
06/02/95	12:56:00	169	164	187	174	174	9.9	175	11.5	
06/02/95	13:37:00	116	106	107	102	108	5.9	105	2.6	
06/02/95	15:01:00	28	7	8	8	13	10.2	8	0.6	
06/02/95	15:36:00	42	18	15	16	23	12.9	16	1.5	
06/02/95	16:37:00	280	121	122	113	159	80.8	119	4.9	
06/02/95	17:27:00	157	54	56	49	79	52.1	53	3.6	
06/02/95	18:06:00		106	112	113	110	3.8	110	3.8	
06/02/95	14:13:00									Recorded over
06/02/95	18:37:40		125	118	117	120	4.4	120	4.4	
06/02/95	19:23:00	272	128	126	135	165	71.3	130	4.7	
06/02/95	19:55:50	188	61	67	58	94	63.1	62	4.6	
06/02/95	20:29:00	193	62	68	61	96	64.7	64	3.8	
06/02/95	21:00:00	168	72	73	71	96	48.0	72	1.0	
06/02/95	23:54:00	108	26	21	27	46	41.7	25	3.2	
06/03/95	01:09:00	37	13	14	12	19	12.0	13	1.0	
06/03/95	02:11:00	97	6	7	8	30	45.0	7	1.0	
06/03/95	02:36:00	36	1	1	1	10	17.5	1	0.0	Part of set not recorded
06/03/95	03:08:00	49	0	0	0	12	24.5	0	0.0	1-Tahoe, part of set not recorded
06/03/95	04:00:00	64	2	2	2	18	31.0	2	0.0	1-Tahoe, part of set not recorded
06/03/95	05:09:00	124	13	16	15	42	54.7	15	1.5	
06/03/95	05:48:00	67	1	1	1	18	33.0	1	0.0	Part of set not recorded
06/03/95	06:48:00	15	3	3	3	6	6.0	3	0.0	Part of set not recorded
06/03/95	07:25:00	16	2	1	1	5	7.3	1	0.6	1-LCT, part of set not recorded
06/03/95	08:20:00	90	65	62	61	70	13.8	63	2.1	
06/03/95	10:25:00	156	81	96	102	109	32.7	93	10.8	Part of set not recorded
06/03/95	11:07:00	292	141	151	137	180	74.7	143	7.2	1large LCT? @ 11:08:06
06/03/95	14:09:00	209	91	106	108	129	54.2	102	9.3	
06/03/95	14:43:00	115	24	29	25	48	44.6	26	2.6	
06/03/95	15:19:00	600	324	291	299	379	148.3	305	17.2	
06/03/95	15:49:00	135	59	53	52	75	40.3	55	3.8	
06/03/95	16:29:00	485	173	173	168	250	156.9	171	2.9	
06/03/95	16:55:00	300	134	126	124	171	86.1	128	5.3	
06/03/95	17:22:54	200	61	73	62	99	67.6	65	6.7	
06/03/95	17:48:49	320	139	135	147	185	90.0	140	6.1	
06/03/95	18:15:43	400	191	194	183	242	105.4	189	5.7	
06/03/95	18:35:00	400	132	125	135	198	134.7	131	5.1	

Appendix 3. A Description of Methods to Estimate Cui-ui Numbers Filmed on Video in 1995.

Date	Time	First Count	Second Count	Third Count	Fourth Count	Mean Count (1st - 4th)	Standard Deviation (1st-4th Counts)	Mean Count (2nd - 4th)	Standard Deviation (2nd-4th Counts)	Comments
06/03/95	18:59:39	350	131	122	125	182	112.1	126	4.6	
06/03/95	19:20:34	350	136	149	138	193	104.7	141	7.0	
06/03/95	19:51:44	164	121	120	124	132	21.2	122	2.1	
06/03/95	20:20:31	186	59	55	54	89	65.0	56	2.6	Blurry images
06/03/95	20:54:00	250	98	101	101	138	75.0	100	1.7	
06/03/95	21:30:55	350	173	168	169	215	90.0	170	2.6	
06/03/95	22:03:07		175	170	162	169	6.6	169	6.6	
06/03/95	22:43:07	345	183	185	186	225	80.2	185	1.5	
06/03/95	23:12:00	192	16	16	15	60	88.2	16	0.6	
06/03/95	23:59:57	505	169	166	179	255	166.9	171	6.8	
06/04/95	00:37:25	320	151	143	150	191	86.1	148	4.4	Part of set not recorded
06/04/95	01:34:27	452	81	82	75	173	186.4	79	3.8	Part of set not recorded
06/04/95	02:08:09	342	20	20	18	100	161.3	19	1.2	
06/04/95	02:42:30	310	99	110	106	156	102.6	105	5.6	
06/04/95	03:13:53	160	79	81	81	100	39.8	80	1.2	
06/04/95	03:56:35	260	59	57	59	109	100.8	58	1.2	Part of set not recorded
06/04/95	04:15:00	300				300				Set not recorded
06/04/95	05:08:48	4	1	1	1	2	1.5	1	0.0	Part of set not recorded
06/04/95	05:51:13	116	17	18	18	42	49.2	18	0.6	
06/04/95	06:21:16	250	41	40	41	93	104.7	41	0.6	
06/04/95	07:02:59	482	122	126	125	214	178.8	124	2.1	
06/04/95	07:40:06	85	71	77	81	79	6.0	76	5.0	Part of set not recorded
06/04/95	08:30:00	120				120				Set was recorded over
06/04/95	09:30:00	440				440				Set was recorded over
06/04/95	10:05:41	217	129	118	127	148	46.4	125	5.9	Part of set not recorded
06/04/95	10:36:34	470	152	143	149	229	161.0	148	4.6	
06/04/95	11:12:24	500	125	145	130	225	183.5	133	10.4	Part of set not recorded
06/04/95	11:37:08		55	50	48	51	3.6	51	3.6	
06/04/95	12:12:20	370	198	210	201	245	83.7	203	6.2	
06/04/95	12:39:28	375	123	130	131	190	123.6	128	4.4	
06/04/95	13:01:32	475	166	184	171	249	150.9	174	9.3	
06/04/95	13:24:26	150	2	2	2	39	74.0	2	0.0	
06/04/95	13:56:23	215	10	11	12	62	102.0	11	1.0	
06/04/95	14:33:32	1150	319	316	310	524	417.5	315	4.6	
06/04/95	15:02:03	286	174	192	177	207	53.1	181	9.6	
06/04/95	15:33:21	544	255	262	276	334	140.1	264	10.7	
06/04/95	16:00:30	391	228	234	217	268	82.6	226	8.6	
06/04/95	16:21:52	275	197	208	194	219	38.1	200	7.4	
06/04/95	17:10:14	194	156	149	143	161	23.0	149	6.5	
06/04/95	17:37:06	260	137	158	143	175	57.7	146	10.8	
06/04/95	18:04:39	157	121	130	109	129	20.4	120	10.5	Lots of Tahoe suckers
06/04/95	18:30:38	104	74	65	68	78	17.9	69	4.6	
06/04/95	19:05:00	200				200				Set not recorded
06/04/95	20:05:01	1	0	0	0	0	0.5	0	0.0	Was entrance gate left closed?
06/04/95	20:28:03	75	51	54	47	57	12.5	51	3.5	Very dim light
06/04/95	20:53:24	63	42	47	51	51	9.0	47	4.5	
06/04/95	21:24:00	148				148				Set not recorded
06/04/95	21:47:34	104	31	35	34	51	35.4	33	2.1	
06/04/95	22:08:04	102	74	71	72	80	14.9	72	1.5	
06/04/95	22:28:18	116	69	64	73	81	24.0	69	4.5	
06/04/95	22:53:42	112	71	78	79	85	18.3	76	4.4	
06/04/95	23:17:39	123	12	12	12	40	55.5	12	0.0	Part of set not recorded

Appendix 3. A Description of Methods to Estimate Cui-ui Numbers Filmed on Video in 1995.

Date	Time	First Count	Second Count	Third Count	Fourth Count	Mean Count (1st - 4th)	Standard Deviation (1st-4th Counts)	Mean Count (2nd - 4th)	Standard Deviation (2nd-4th Counts)	Comments
06/04/95	23:55:14	152	134	136	134	139	8.7	135	1.2	
06/04/95	12:47:19	411	177	165	179	233	118.8	174	7.6	
06/05/95	01:49:15	58	39	39	44	45	9.0	41	2.9	
06/05/95	02:43:13	270	107	108	116	150	79.9	110	4.9	Part of set not recorded
06/05/95	03:32:41	77	68	64	66	69	5.9	66	2.1	Part of set not recorded
06/05/95	04:05:39	178	50	52	53	83	63.2	52	1.5	Part of set not recorded
06/05/95	04:50:05	193	114	122	121	138	37.2	119	4.4	
06/05/95	06:04:59	55	33	32	33	38	11.2	33	0.6	Part of set not recorded
06/05/95	06:41:06	76	67	69	66	70	4.5	67	1.5	Part of set not recorded
06/05/95	07:15:07	335	166	164	173	210	83.8	168	4.7	
06/05/95	08:00:46	151	159	162	169	160	7.5	163	5.1	Part of set not recorded
06/05/95	08:50:12	210	157	147	153	167	29.1	152	5.0	
06/05/95	09:53:30	225	52	53	53	96	86.2	53	0.6	Part of set not recorded
06/05/95	10:31:07	115	18	19	20	43	48.0	19	1.0	Part of set not recorded
06/05/95	10:58:27	152	77	76	72	94	38.6	75	2.6	Part of set not recorded
06/05/95	12:19:00	567				567				Set was recorded over @ 1:01
06/05/95	13:01:33	410	120	123	126	195	143.5	123	3.0	
06/05/95	15:17:01	307	234	281	251	268	32.3	255	23.8	
06/05/95	16:53:00		127	111	116	118	8.2	118	8.2	Numerous Tahoes? at beginning
06/05/95	17:28:07		59	55	51	55	4.0	55	4.0	
06/05/95	18:44:33	141	92	92	96	105	23.9	93	2.3	1-LCT @ 6:44:46?
06/05/95	19:41:25	106	79	72	76	83	15.4	76	3.5	
06/05/95	21:13:57	21	7	7	7	11	7.0	7	0.0	
06/05/95	22:53:07	37	13	12	14	19	12.0	13	1.0	
06/05/95	23:50:45	16	1	1	1	5	7.5	1	0.0	Smaller targets likely Tahoes
06/06/95	06:57:31	165	0	0	0	41	82.5	0	0.0	Part of set not recorded, 3-Tahoes, recorded over set on 6/5 @ 11:52 pm
06/06/95	00:39:16	120	1	1	1	31	59.5	1	0.0	Part of set not recorded, 1-LCT @ 12:39:43
06/06/95	02:33:15	0	0	0	0	0	0.0	0	0.0	Part of set not recorded
06/06/95	03:27:46	72	0	0	0	18	36.0	0	0.0	1-Tahoe sucker?
06/06/95	04:32:30	35	0	0	0	9	17.5	0	0.0	4-Tahoe suckers?
06/06/95	05:29:36	20	1	1	1	6	9.5	1	0.0	
06/06/95	08:06:51	15	0	0	0	4	7.5	0	0.0	Part of set not recorded, ~7-Tahoes
06/06/95	09:24:30	8	2	2	2	4	3.0	2	0.0	~6-Tahoe suckers
06/06/95	10:15:00	10				10				Set not recorded
06/06/95	15:39:10	51	16	16	15	25	17.7	16	0.6	
06/06/95	17:30:17	163	122	103	107	124	27.4	111	10.0	
06/06/95	18:47:39	149	103	112	94	115	24.1	103	9.0	
06/06/95	20:02:06	66	30	34	37	42	16.4	34	3.5	Lots of Tahoe suckers
06/06/95	20:35:29	42	22	23	24	28	9.5	23	1.0	
06/06/95	21:15:50	57	21	15	18	28	19.7	18	3.0	
06/06/95	21:58:29	55	21	23	24	31	16.2	23	1.5	
06/06/95	22:45:19	32	7	6	6	13	12.8	6	0.6	
06/06/95	23:48:39	35	4	3	3	11	15.8	3	0.6	
06/07/95	00:47:44	57	5	6	5	18	25.8	5	0.6	
06/07/95	10:40:42	15	7	7	8	9	3.9	7	0.6	Part of set not recorded
06/07/95	18:37:33	42	27	24	25	30	8.4	25	1.5	
06/07/95	20:21:19	39	8	7	6	15	16.0	7	1.0	
06/07/95	21:57:19	19	7	7	7	10	6.0	7	0.0	
06/07/95	23:29:55	11	2	2	2	4	4.5	2	0.0	
06/08/95	16:27:48	1026	856	864	983	932	85.3	901	71.1	Counts estimated by lots of 10; fish displaced water
06/08/95	17:38:45	622	546	626	587	595	37.2	586	40.0	Counts estimated by lots of 10
06/08/95	18:36:19	215	164	159	161	175	26.9	161	2.5	

Appendix 3. A Description of Methods to Estimate Cui-ui Numbers Filmed on Video in 1995.

Date	Time	First Count	Second Count	Third Count	Fourth Count	Mean Count (1st - 4th)	Standard Deviation (1st-4th Counts)	Mean Count (2nd - 4th)	Standard Deviation (2nd-4th Counts)	Comments
06/08/95	20:31:04	143	71	65	62	85	38.7	66	4.6	
06/08/95	21:14:00	179				179				Set not recorded
06/08/95	23:01:44	20	5	5	5	9	7.5	5	0.0	2-Tahoes in turbulence at beginning
06/08/95	23:46:13	32	1	4	3	10	14.7	3	1.5	3rd & 4th counts may include Tahoes
06/09/95	01:25:00	20	2	2	2	7	9.0	2	0.0	Targets could be large Tahoes
06/09/95	17:58:12	78	35	33	37	46	21.6	35	2.0	
06/09/95	19:31:39	65	31	34	32	41	16.4	32	1.5	
06/09/95	21:55:49	12	0	0	0	3	6.0	0	0.0	
06/09/95	23:42:47	53	5	5	6	17	23.8	5	0.6	
06/11/95	21:30:00	0				0				Set not recorded
06/11/95	22:27:14		0	0	0	0	0.0	0	0.0	
06/11/95	23:41:29	0	0	0	0	0	0.0	0	0.0	
06/12/95	06:41:24	15	0	0	0	4	7.5	0	0.0	
06/12/95	16:15:03	3	1	1	1	2	1.0	1	0.0	
06/12/95	17:37:50	28	1	1	1	8	13.5	1	0.0	Part of set not recorded
06/12/95	20:24:16	1	0	0	0	0	0.5	0	0.0	Blurry, slightly out of focus
06/12/95	22:48:26		0	0	0	0	0.0	0	0.0	Part of set not recorded
06/13/95	00:01:26	0	0	0	0	0	0.0	0	0.0	
06/13/95	01:06:41	115	0	0	0	29	57.5	0	0.0	
06/13/95	03:50:20	63	2	2	2	17	30.5	2	0.0	
06/13/95	05:35:43	20	0	0	0	5	10.0	0	0.0	1-Tahoe
06/13/95	11:51:25	13	0	0	0	3	6.5	0	0.0	Tahoe suckers only
06/13/95	13:39:39	20	2	2	3	7	8.8	2	0.6	4th count may include 1-Tahoe
06/13/95	15:37:54	5	0	0	0	1	2.5	0	0.0	2-large Tahoes
06/13/95	16:52:28		0	0	0	0	0.0	0	0.0	
06/13/95	18:01:01	11	0	0	0	3	5.5	0	0.0	
06/14/95	02:01:42	0	0	0	0	0	0.0	0	0.0	
06/14/95	06:46:36	2	1	1	1	1	0.5	1	0.0	
	Sub-totals	28580	12158	12387	12353	17862		12299		

Appendix 4. 1995 Cui-ui Counts From Video Footage of River Trap Releases.

Regression estimates were applied to 16 counts if filmed releases were erased by applying the following equation, $Y=0.12733(X)^{1.21}$, where Y is the estimated count and X is the value of the first count. A proportional density estimate (designated as "Estimate of Missing Data") was added to mean counts (2nd - 4th counts) for 20 river trap releases where estimates of time could be applied to a missing segment of the release.

Date	Time	First Count	Mean Count (2nd - 4th)	Estimate from applied regression equation	Estimate of Missing Data	Estimated Total Number Released	Daily Totals	Comments
NR	NR		0			0		
NR	NR		0			0		
NR	NR		11			11		
NR	NR		40			40		
NR	NR		1			1		Camera repositioned
NR	NR		0			0		2-Tahoes
NR	NR		0			0		4-Tahoes
NR	NR		0			0		
NR	NR		0			0		
NR	NR		0			0	52	
04/29/95	22:40:00	52		15		15	15	Could not determine sets on tape
05/10/95	23:02:00	4	0			0	0	MBFF 95' Tape #1, 5-Tahoes
06/01/95	18:13:00	190		73		73		Could not determine sets on tape
06/01/95	18:30:00	300		126		126		Could not determine sets on tape
06/01/95	23:48:00	49	18			18	217	
06/02/95	10:42:00	245	193			193		Sunlight glare
06/02/95	12:56:00	169	175			175		
06/02/95	13:37:00	116	105			105		
06/02/95	15:01:00	28	8			8		
06/02/95	15:36:00	42	16			16		
06/02/95	16:37:00	280	119			119		
06/02/95	17:27:00	157	53			53		
06/02/95	18:06:00		110			110		
06/02/95	14:13:00				58	58		Recorded over, average between 13:37 & 15:01 sets
06/02/95	18:37:40		120			120		
06/02/95	19:23:00	272	130			130		
06/02/95	19:55:50	188	62			62		
06/02/95	20:29:00	193	64			64		
06/02/95	21:00:00	168	72			72		
06/02/95	23:54:00	108	25			25	1307	
06/03/95	01:09:00	37	13			13		
06/03/95	02:11:00	97	7			7		
06/03/95	02:36:00	36	1			1		Part of set not recorded, not likely any other fish
06/03/95	03:08:00	49	0			0		1-Tahoe, part of set not recorded, not likely any other fish
06/03/95	04:00:00	64	2			2		1-Tahoe, part of set not recorded, not likely any other fish
06/03/95	05:09:00	124	15			15		
06/03/95	05:48:00	67	1			1		Part of set not recorded, not likely any other fish
06/03/95	06:48:00	15	3			3		Part of set not recorded, not likely any other fish
06/03/95	07:25:00	16	1			1		1-LCT, part of set not recorded, not likely any other fish
06/03/95	08:20:00	90	63			63		
06/03/95	10:25:52	156	93		210	303		Part of set not recorded, 35 fish/sec *6sec=210fish
06/03/95	11:07:00	292	143			143		1large LCT? @ 11:08:06

25

Appendix 4. 1995 Cui-ui Counts From Video Footage of River Trap Releases.

Regression estimates were applied to 16 counts if filmed releases were erased by applying the following equation, $Y=0.12733(X)^{1.21}$, where Y is the estimated count and X is the value of the first count. A proportional density estimate (designated as "Estimate of Missing Data") was added to mean counts (2nd - 4th counts) for 20 river trap releases where estimates of time could be applied to a missing segment of the release.

Date	Time	First Count	Mean Count (2nd - 4th)	Estimate from applied regression equation	Estimate of Missing Data	Estimated Total Number Released	Daily Totals	Comments
06/03/95	14:09:00	209	102			102		
06/03/95	14:43:00	115	26			26		
06/03/95	15:19:00	600	305			305		
06/03/95	15:49:00	135	55			55		
06/03/95	16:29:00	485	171			171		
06/03/95	16:55:00	300	128			128		
06/03/95	17:22:54	200	65			65		
06/03/95	17:48:49	320	140			140		
06/03/95	18:15:43	400	189			189		
06/03/95	18:35:00	400	131			131		
06/03/95	18:59:39	350	126			126		
06/03/95	19:26:34	350	141			141		
06/03/95	19:51:44	164	122			122		
06/03/95	20:20:31	186	56			56		Blurry images
06/03/95	20:54:00	250	100			100		
06/03/95	21:30:55	350	170			170		
06/03/95	22:03:07		169			169		
06/03/95	22:43:07	345	185			185		
06/03/95	23:12:00	192	16			16		
06/03/95	23:59:57	505	171			171	3119	
06/04/95	00:37:25	320	148		21	169		Part of set not recorded, 3fish/sec*7sec=21fish
06/04/95	01:34:27	452	79	208		208		Part of set not recorded, apply regression estimate
06/04/95	02:08:09	342	19			19		
06/04/95	02:42:30	310	105			105		
06/04/95	03:13:53	160	80			80		
06/04/95	03:56:35	260	58		120	178		Part of set not recorded, 12fish/sec*10sec=120fish
06/04/95	04:15:00	300		126		126		Set not recorded
06/04/95	05:08:48	4	1		3	4		Part of set not recorded (~55%), add 3 additional fish
06/04/95	05:51:13	116	18			18		
06/04/95	06:21:16	250	41			41		
06/04/95	07:02:59	482	124			124		
06/04/95	07:40:06	85	76		120	196		Part of set not recorded, 12fish/sec*10sec=120fish
06/04/95	08:30:00	120		42		42		Set was recorded over
06/04/95	09:30:00	440		201		201		Set was recorded over
06/04/95	10:05:41	217	125		100	225		Part of set not recorded, 20fish/sec*5sec=100 fish
06/04/95	10:36:34	470	148		150	298		Part of set not recorded, 30fish/sec*5sec=150fish
06/04/95	11:12:24	500	133		150	283		Part of set not recorded, 10fish/sec*15sec=150fish
06/04/95	11:37:08		51			51		
06/04/95	12:12:20	370	203			203		
06/04/95	12:39:28	375	128			128		
06/04/95	13:01:32	475	174			174		
06/04/95	13:24:26	150	2			2		

Appendix 4. 1995 Cui-ui Counts From Video Footage of River Trap Releases.

Regression estimates were applied to 16 counts if filmed releases were erased by applying the following equation, $Y=0.12733(X)^{1.21}$, where Y is the estimated count and X is the value of the first count. A proportional density estimate (designated as "Estimate of Missing Data") was added to mean counts (2nd - 4th counts) for 20 river trap releases where estimates of time could be applied to a missing segment of the release.

Date	Time	First Count	Mean Count (2nd - 4th)	Estimate from applied regression equation	Estimate of Missing Data	Estimated Total Number Released	Daily Totals	Comments
06/04/95	13:56:23	215	11			11		
06/04/95	14:33:32	1150	315			315		
06/04/95	15:02:03	286	181			181		
06/04/95	15:33:21	544	264			264		
06/04/95	16:00:30	391	226			226		
06/04/95	16:21:52	275	200			200		
06/04/95	17:10:14	194	149			149		
06/04/95	17:37:08	260	146			146		
06/04/95	18:04:39	157	120			120		Lots of Tahoe suckers
06/04/95	18:30:38	104	69			69		
06/04/95	19:05:00	200		77		77		Set not recorded
06/04/95	20:05:01	1	0			0		Was entrance gate left closed?
06/04/95	20:28:03	75	51			51		Very dim light
06/04/95	20:53:24	63	47			47		
06/04/95	21:24:00	148		54		54		Set not recorded
06/04/95	21:47:34	104	33			33		
06/04/95	22:08:04	102	72			72		
06/04/95	22:28:18	116	69			69		
06/04/95	22:53:42	112	76			76		
06/04/95	23:17:39	123	12	43		43		Part of set not recorded, apply regression estimate
06/04/95	23:55:14	152	135			135		
06/04/95	12:47:19	411	174			174	5387	
06/05/95	01:49:15	58	41			41		
06/05/95	02:43:13	270	110		60	170		Part of set not recorded, 15fish/sec*4sec=60fish
06/05/95	03:32:41	77	66		100	166		Part of set not recorded, 20fish/sec*5sec=100fish
06/05/95	04:05:39	178	52		65	117		Part of set not recorded, 15fish/sec*5sec=65fish
06/05/95	04:50:05	193	119			119		
06/05/95	06:04:59	55	33		100	133		Part of set not recorded, 10fish/sec*10sec=100fish
06/05/95	06:41:06	76	67		80	147		Part of set not recorded, 10fish/sec*8sec=80fish
06/05/95	07:15:07	335	168			168		
06/05/95	08:00:46	151	163		180	343		Part of set not recorded, 30fish/sec*6sec=180fish
06/05/95	08:50:12	210	152			152		
06/05/95	09:53:30	225	53		130	183		Part of set not recorded, 13fish/sec*10sec=130fish
06/05/95	10:31:07	115	19		80	99		Part of set not recorded, 8fish/sec*10sec=80fish
06/05/95	10:58:27	152	75		65	140		Part of set not recorded, 15fish/sec*5sec=65fish
06/05/95	12:19:00	567		273		273		Set was recorded over @ 1:01
06/05/95	13:01:33	410	123			123		
06/05/95	15:17:01	307	255			255		
06/05/95	16:53:00		118			118		Numerous Tahoes? at beginning
06/05/95	17:28:07		55			55		
06/05/95	18:44:33	141	93			93		1-LCT @ 6:44:46?
06/05/95	19:41:25	106	76			76		

Appendix 4. 1995 Cui-ui Counts From Video Footage of River Trap Releases.

Regression estimates were applied to 16 counts if filmed releases were erased by applying the following equation, $Y=0.12733(X)^{1.21}$, where Y is the estimated count and X is the value of the first count. A proportional density estimate (designated as "Estimate of Missing Data") was added to mean counts (2nd - 4th counts) for 20 river trap releases where estimates of time could be applied to a missing segment of the release.

Date	Time	First Count	Mean Count (2nd - 4th)	Estimate from applied regression equation	Estimate of Missing Data	Estimated Total Number Released	Daily Totals	Comments
06/05/95	21:13:57	21	7			7		
06/05/95	22:53:07	37	13			13		
06/05/95	23:50:45	16	1			1	2992	Smaller targets likely Tahoes
06/06/95	06:57:31	165	0		0	0		Part of set not recorded, 3-Tahoes, recorded over set on 6/5 @ 11:52 pm, no change
06/06/95	00:39:16	120	1		5	6		Part of set not recorded, 1-LCT @ 12:39:43, 1fish/sec*5sec=5fish
06/06/95	02:33:15	0	0		0	0		Part of set not recorded, no change
06/06/95	03:27:46	72	0			0		1-Tahoe sucker?
06/06/95	04:32:30	35	0			0		4-Tahoe suckers?
06/06/95	05:29:36	20	1			1		
06/06/95	08:06:51	15	0	3		3		Part of set not recorded, ~7-Tahoes, apply regression
06/06/95	09:24:30	8	2			2		~6-Tahoe suckers
06/06/95	10:15:00	10		2		2		Set not recorded
06/06/95	15:39:10	51	16			16		
06/06/95	17:30:17	163	111			111		
06/06/95	18:47:39	149	103			103		
06/06/95	20:02:06	66	34			34		Lots of Tahoe suckers
06/06/95	20:35:29	42	23			23		
06/06/95	21:15:50	57	18			18		
06/06/95	21:58:29	55	23			23		
06/06/95	22:45:19	32	6			6		
06/06/95	23:48:39	35	3			3	350	
06/07/95	00:47:44	57	5			5		
06/07/95	10:40:42	15	7		6	13		Part of set not recorded, 0.5fish/sec*12sec=6fish
06/07/95	18:37:33	42	25			25		
06/07/95	20:21:19	39	7			7		
06/07/95	21:57:19	19	7			7		
06/07/95	23:29:55	11	2			2	60	
06/08/95	16:27:48	1026	901			901		Counts estimated by lots of 10; fish displaced water
06/08/95	17:38:45	622	586			586		Counts estimated by lots of 10
06/08/95	18:36:19	215	161			161		
06/08/95	20:31:04	143	66			66		
06/08/95	21:14:00	179		68		68		Set not recorded
06/08/95	23:01:44	20	5			5		2-Tahoes in turbulence at beginning
06/08/95	23:46:13	32	3			3	1790	3rd & 4th counts may include Tahoes
06/09/95	01:25:00	20	2			2		Targets could be large Tahoes
06/09/95	17:58:12	78	35			35		
06/09/95	19:31:39	65	32			32		
06/09/95	21:55:49	12	0			0		
06/09/95	23:42:47	53	5			5	75	
06/11/95	21:30:00	0		0		0		Set not recorded
06/11/95	22:27:14		0			0		
06/11/95	23:41:29	0	0			0	0	

Appendix 4. 1995 Cui-ui Counts From Video Footage of River Trap Releases.

Regression estimates were applied to 16 counts if filmed releases were erased by applying the following equation, $Y=0.12733(X)^{1.21}$, where Y is the estimated count and X is the value of the first count. A proportional density estimate (designated as "Estimate of Missing Data") was added to mean counts (2nd - 4th counts) for 20 river trap releases where estimates of time could be applied to a missing segment of the release.

Date	Time	First Count	Mean Count (2nd - 4th)	Estimate from applied regression equation	Estimate of Missing Data	Estimated Total Number Released	Daily Totals	Comments
06/12/95	06:41:24	15	0			0		
06/12/95	16:15:03	3	1			1		
06/12/95	17:37:50	28	1	7		7		Part of set not recorded, apply regression
06/12/95	20:24:16	1	0			0		Blurry, slightly out of focus
06/12/95	22:48:26		0			0	8	Part of set not recorded, no change (~7 sec recording)
06/13/95	00:01:26	0	0			0		
06/13/95	01:06:41	115	0			0		
06/13/95	03:50:20	63	2			2		
06/13/95	05:35:43	20	0			0		1-Tahoe
06/13/95	11:51:25	13	0			0		Tahoe suckers only
06/13/95	13:39:39	20	2			2		4th count may include 1-Tahoe
06/13/95	15:37:54	5	0			0		2-large Tahoes
06/13/95	16:52:28		0			0		
06/13/95	18:01:01	11	0			0	4	
06/14/95	02:01:42	0	0			0		
06/14/95	06:46:36	2	1			1	1	
	Sub-totals	28580	12299	1319	1801	15377	15377	

Appendix 5. Number of Cui-ui Transported by Truck and Released Upstream from the Marble Bluff Fish Facility in 1995.

Location designated by L- represent a specified ladder. The terminal ladder is designated as L-4 . Other ladders are sequentially numbered upstream from the terminal ladder.

Date	Time	Location	Number	Daily Total	Comments
04/07/95	17:00	L-4	314	314	Trial transportation exercise
04/28/95	18:52	L-4	454		
	20:20	L-4	452		
	22:00	L-4	450		
	23:30	L-4	450	1806	
04/29/95	01:30	L-4	450		
	03:30	L-4	450		
	05:00	L-4	450	1350	
04/30/95	16:00	L-3	310		
	21:30	L-3	474	784	
05/01/95	23:00	L-3	301	301	
06/02/95	09:00	L-4	280		
	11:00	L-3	80		
	13:00	L-3	385		
	15:00	L-3	331		
	16:00	L-3	369		
	17:40	L-3	227		
	18:15	L-2	110		
	19:30	L-3	299	2081	
06/03/95	10:30	L-4	100		~1500 fish were planted back into fishway near building due to tank failure and 100 put in river
	12:30	L-4	600		
	15:21	L-4	600		
	17:10	L-4	621		
	18:40	L-4	627		Sex ratio 94 males : 82 females
	19:00	L-3	223		
	21:00	L-4	314		
	21:30	L-4	200		
	21:45	L-3	400		
	22:17	L-3	306		
	22:56	L-3	1255		
	23:40	L-3	317	5563	
06/04/95	12:00	L-3	243		
	12:55	BLDG.	1127		Fish were netted downstream from bldg.
	17:00	L-4	739		
	18:00	L-3	202	2311	
	TOTAL TRANSPORTED			14510	

END

01-22-99